

The Triassic in Southwest Bulgaria. Upper Triassic red beds (Moesian Group) in the Golo-bârdo unit

Kiril Budurov, Ivan Zagorčev, Ekaterina Trifonova

Geological Institute, Bulgarian Academy of Sciences, 1113 Sofia

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К. Будуров, И. Загорчев, Е. Трифонова — Триас в Юго-Западной Болгарии. Верхнетриасовые красноцветные отложения (Мизийская группа) в Голобырдской единице. Верхнетриасовые красноцветные отложения (Мизийская группа) в Голобырдской единице подразделены на три свиты. Самая нижняя, Славейская свита залегает над верхнетриасовой доломитовой Русиновделской свитой и сложена из пестроцветных мергелей, доломитов и оолитовых, желваковых или биодетритовых известняков, часто содержащих остатки фораминифер, остракод, водорослей и копролитов. Фораминиферовое сообщество включает *Angulodiscus friedli*, *Nodosaria ordinata* и *Semiinvoluta clari* и указывает на норийский возраст. Последующие, Комшtica свита (красноцветные сланцы, алевролиты и песчаники) и Ветрушская свита (пестроцветные конгломераты, сложенные из карбонатных обломков) расположены в суперпозиции и латерально сочленены. Разрез Мизийской группы перекрывается с размывом и небольшим несогласием среднеюрской Полатенской свитой.

Обломки Ветрушской свиты происходят в основном из верхнетриасовых Русиновделской и Трынской свит и из анизийско-ладинской Радомирской свиты. Обломки из Радомирской свиты содержат конodontы, указывающие на конodontные зоны *Pridaella cornuta* R. Z., *Pridaella excentrica* R. Z. и *Pridaella bakalovi* R. Z. Состав обломков в Ветрушской свите указывает на их возможный источник — Любашскую единицу (расположенную к северо-западу от Голобырдской единицы), так как нижнетриасовые и нижнеанизийские свиты в этой единице непосредственно покрываются ниже- и среднеюрскими свитами, и таким образом свидетельствуют о глубокой поздне триасовой эрозии и денудации. Этот факт опровергает мнение о полной аллохтонности Голобырдской единицы.

Abstract. The Upper Triassic red beds (Moesian Group) in the Golo-bârdo unit are subdivided into three formations. The basal Slavey Formation is situated over the Upper Triassic dolomitic Rusinovdel Formation, and consists of variegated marls, dolomites, and oolitic, nodular or biotrititic limestones often containing foraminifers, ostracods, algae and coprolites. The foraminiferal assemblage includes *Angulodiscus friedli*, *Nodosaria ordinata* and *Semiinvoluta clari*, and indicates a Norian age. The following Komštica Formation (red shales, siltstones and sandstones) and Vetrúška Formation (variegated conglomerates built up of carbonatic pebbles) are situated in superposition and with lateral interfingering. The section of the Moesian Group in the Golo-bârdo unit is covered after wash-out and with a slight unconformity by the Middle Jurassic Polaten Formation.

The pebbles in the Vetrúška Formation come mostly from the Upper Triassic Rusinovdel and Trán Formations, and the Anisian-Ladinian Radomir Formation. The pebbles from the Radomir Formation yielded conodonts which prove the conodont zones *Pridaella cornuta* R. Z., *Pridella excentrica* I. Z. and *Pridaella bakalovi* R. Z. The pebble content of the Vetrúška Formation hints to the Ljubaš unit (situated at northwest of the Golo-bârdo unit) as the possible source area of the pebbles as far as the Lower Triassic and Lower Anisian formations in this unit are covered directly by Lower and Middle Jurassic formations thus indicating a deep Late Triassic erosion and denudation. This evidence disproves the ideas about a complete allochthoneity of the Golo-bârdo unit.

Introduction

The Golo-bârdo tectonic unit has been introduced as an allochthonous thrust sheet by Гочев (1983) who pointed at the differences between the Golo-bârdo sequences and the Al-

pine sections in the adjacent tectonic units. These differences were further detailed by З а г о р ч е в (1990) who compared the Golo-bârdo tectonic unit with the other units in Southwest Bulgaria. However, the tectonic relations are still not sufficiently elucidated, and our studies are partially aiming to solve problems of the tectonic position and evolution of the unit.

The Upper Triassic red beds in Bulgaria (and in Southwest Bulgaria in particular) have been continuously confounded with Lower Triassic and Permian red beds. However, in the Golo-bârdo Mt., С т е ф а н о в (1932) reported the presence of variegated breccias and conglomerates, variegated and mainly red marls and shaly-marly sandstones overlying the referred to the Norian "Hauptdolomit", and thus supposed to be of Rhaetian age. М о е в (1968) referred also the Upper Triassic red beds to the Rhaetian, and pleaded for the presence of an unconformity between them and the underlying Upper Triassic dolomite. However, later (М о е в, 1980) he suggested the presence of a gradual transition, and proved the unconformable position of the Middle Jurassic over the Triassic section. Т р о н к о в (1975) referred the Upper Triassic red beds to the Komštica Formation. The first fossil finding in the westernmost part of the exposures of the Komštica Formation in Southwest Bulgaria (Т р и ф о н о в а & З а г о р ч е в, 1984) indicated, that at least its uppermost parts belong to the Norian (possibly, even to the Upper Norian).

The present study aims to elucidate the stratigraphic problems of the Upper Triassic red beds (Moesian Group) in the Golo-bârdo Mountain for to enable a broader regional correlation, and the establishment of the paleogeographic and paleogeodynamic features of the Golo-bârdo tectonic unit.

The field work for this study was made over a long period of time in the scope of different projects of the Geological Institute (Bulgarian Academy of Sciences) and the Enterprise for Geophysical Survey and Geological Mapping (now — Geology and Geophysics Ltd.) of the Committee of Geology. Thus, K. Budurov and S. Stefanov studied and sampled limestone pebbles in the red beds as early as 1962, and additional study on the heights Rančovo gradiste and Vetruška was made by K. Budurov in 1978-1979. These pebbles belong mainly to the lower parts (Biten Member) of the Radomir Formation, and the conodonts yielded indicate the conodont zone *Pridaella cornuta* R. Z. thus defining the Illyrian Substage of the Anisian (B u d u r o v, 1980). The studies on the Triassic of the Golo-bârdo Mts. continued since 1986 in the scope of the Geological Map of Bulgaria on the scale 1:100 000 (Z a g o r ч e в, D i n k o в а, 1991; Z a g o r ч e в et al., 1991). The preparation of the present paper was financed by the National Fund "Scientific Research" under the project "Paleogeodynamics of Bulgaria in the Mesozoic and Tertiary".

The red bed sequence

The red beds in the Golo-bârdo unit contain different lithologic varieties. The following rocks are predominant:

— red and variegated breccias and conglomerates; they are built up of slightly rounded fragments of limestones (mostly dark grey originating from the Radomir Formation, or light grey to whitish, and aphanitic obviously coming from the Trân Formation) and dolomites; the fragment dimensions vary between several millimeters and 15-20 cm, some bigger fragments being rarely found;

— variegated fine-pebble and peloidal breccias and conglomerates: the dimensions of the fragments vary between 0.2 and 3 cm; the fragments represent greyish limestones or dolomite in a red carbonatic to argillaceous matrix; a number of "pebbles" are red carbonatic peloids with unknown origin;

— polymictic red to variegated sandstones;

— oligomictic quartzite-like quartz sandstones;

— red siltstones to shales; often contain ellipsoidal reduction spots with regular shape and similar orientation and axial ratios within a deformation domain (used as strain indi-

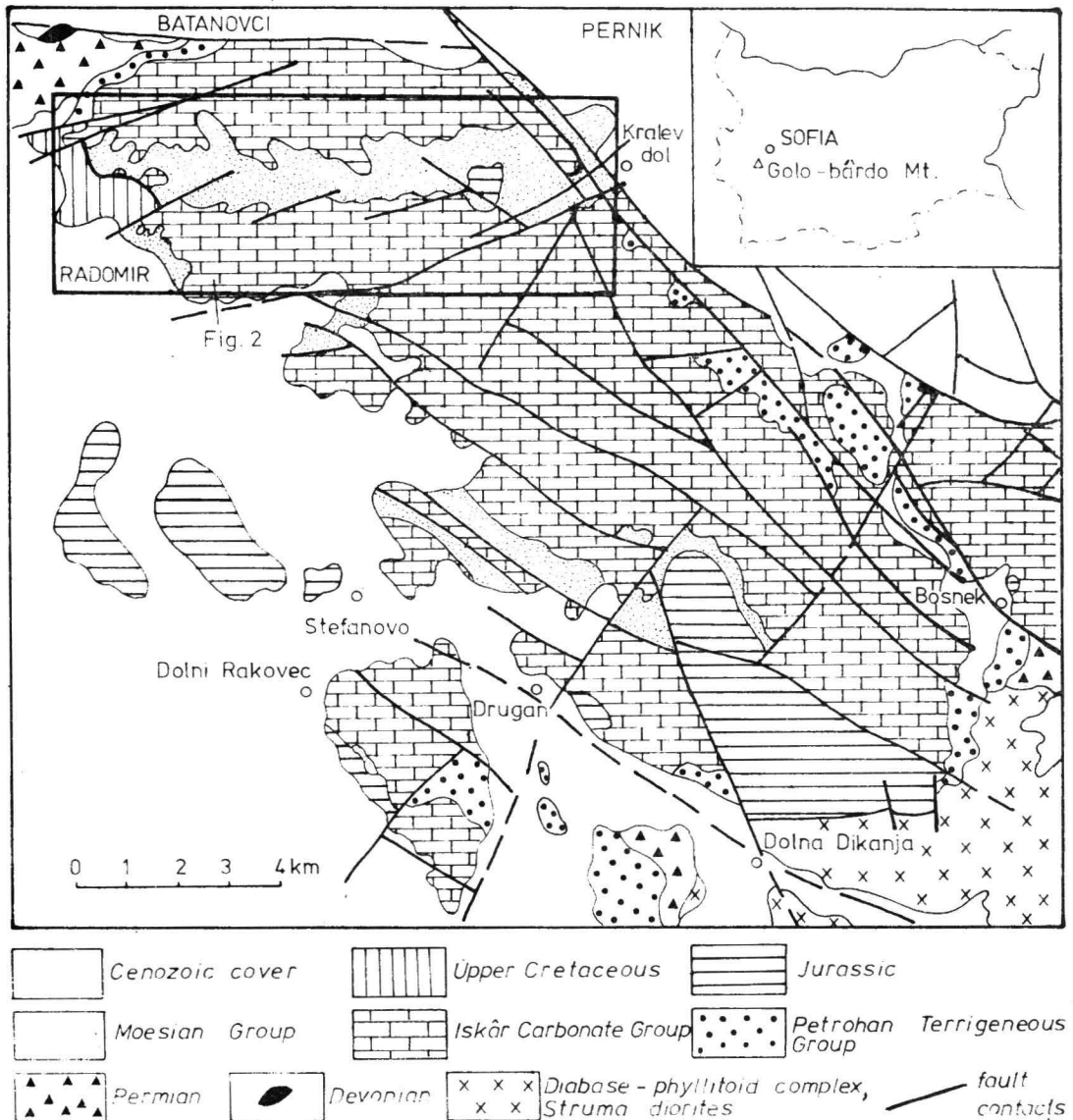


Fig. 1. Geological sketch map of the Golo-bârdo unit (modified after Zagorčev & Marinova, 1991)

caters) as well as irregular greenish sectors or layers; carbonate concretions with irregular shape are also observed;

- reddish, pinkish or yellowish marls;
- reddish or greyish red limestones, often with a nodular structure; dark-grey limestones, light-grey limestones, light-grey fine-grained dolomites.

The following section has been studied near the mountain hut Slavey (beginning in the heights west of the hut, and continuing along the road downwards to the first outcrops of the dolomites of the Rusinovdel Formation:

6. Variegated breccias and conglomerates built up of limestone and dolomite pebbles; bedding from 145-180°/30-50° to SW or W; total thickness more than 60 m.

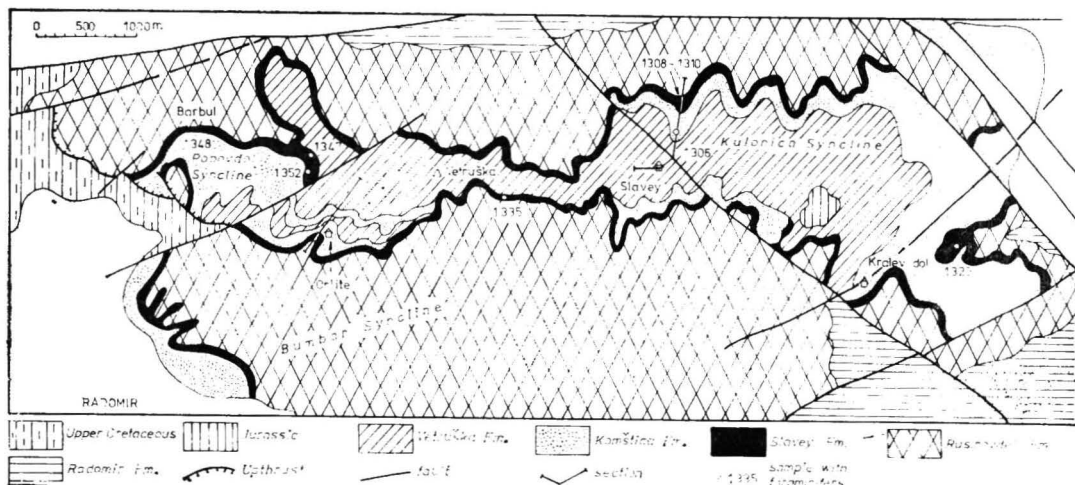


Fig. 2. Geological map of the area between Radomir and Kraljev dol (mapping by I. Zagorčev)

5. Red fine siltstones to shales containing separate limestone fragments, marly or carbonatic concretions, and greenish reduction spots; bedding $180^{\circ}/30^{\circ}$ W
 sample 1306 — carbonatic concretion 10 m
 sample 1307 — carbonatic siltstone
 4. Reddish to variegated pelloid breccia with 5-20 cm intervals built up of red silty sandstones; bedding $50-65^{\circ}/20-50^{\circ}$ SE; thickness about 5 m
 3. Dark-grey banded limestones, bedding $80^{\circ}/60^{\circ}$ SE 0.70 m
 sample 1308 — limestone
 2. Red to reddish-grey limestones, partially marly, with abundant macrofossil remnants 1.30 m
 sample 1309 — limestone
 1. Greyish or reddish nodular and banded limestones 1.30 m
 sample 1310 — limestone
- basement: brecciated grey dolomites (Rusinovdel Formation).

Another important section is situated NE of the town of Radomir and the mountain hut Orlice (south of the height Orle SW of the peak Vetruška):

5. Variegated reddish breccia and conglomerates consisting of limestone and dolomite pebbles 90 m
 4. Red shales and siltstones interbedded by conglomerates, pelloid breccias and conglomerates, and red sandstones 25 m
 3. Variegated red breccia of carbonatic pebbles and red carbonatic to shaly matrix 35 m
 2. Red shales and siltstones interlayered with red banded sandstones; bedding $40^{\circ}/15^{\circ}$ NW, slaty cleavage $120^{\circ}/70^{\circ}$ NNE 16 m
 1. Alternation of greenish, yellowish and reddish marls and limestones (often biodetritic and oolitic) with reddish shales and fine-grained greyish dolomites 5 m
- basement: brecciated grey dolomites (Rusinovdel Formation)

The observations over the whole area of occurrence of the Upper Triassic red beds (figs. 1, 2) show that the section usually consists of three distinct parts (from top to bottom):

1. Polymictic breccia to conglomerate, red to variegated, built up of carbonatic (limestones and dolomites) pebbles within a carbonatic or marly matrix; the thickness is between 60 and 100 m, the maximum thickness is about 200-250 m; this unit is interlayered by red sandstones, siltstones and shales in thin single beds or packets.

2. Red siltstones (grading to sandstones, shales or marls) interlayered by quartz oligomictic sandstones, fine-pebble breccia or conglomerate to pelloid conglomerate, and occasional limestone or dolomite; single layers (up to 30-40 m thick) of conglomerate may appear amidst the red siltstones, and their thickness (without the thick conglomerate interlayers when present) varies from 0 to 40 m, rarely up to 150 m; locally the red siltstones (grading to sandstone, shale or marl) may be rather pure of coarse terrigenous interlayers.

3. Reddish, greyish, greenish or yellowish limestones, marls, dolomites, oolitic, biotrititic or nodular limestones with a total thickness of 3 to 10-12 m are always present at the base of the Upper Triassic red beds, and cover directly the brecciated dolomites of the Rusinovdel Formation; locally the relations seem to be unconformable.

Composition of the pebbles

The macroscopic inspection of the pebbles in the Upper Triassic variegated breccia and conglomerate in the Golo-bârdo Mountain shows that the dominant majority of them are carbonatic, and belong to three types: 1) dark-grey to blackish limestones; 2) light-grey to whitish aphanitic limestones; 3) grey dolomites. These carbonate types correspond to the prevalent rock types in the Radomir Formation, upper parts of the Radomir Formation or Trân Formation, and Rusinovdel Formation, respectively.

A more thorough investigation of the pebbles was made by one of the authors (K. Budurov) who sampled three different levels within the 60 m thick polymictic breccia near the mountain hut Slavey. The vertical difference between the sampled levels is roughly about 30 m, the second level being in the midst of the sequence, and the first and third level being at the base and at the top, respectively.

The first level (at the base of the breccia) contains about 48% of limestone pebbles until the other two levels contain 37-40% limestone pebbles (Table 1). The percentage of the conodont-bearing limestone pebbles is fairly constant: about 9-11% of the total amount of pebbles, and 23-27% of the limestone pebbles. Conodonts have been found only in the pebbles from the Radomir Formation. They allow for to define the conodont zones *Pridaella cornuta* R. Z. (Illyrian Substage of the Anisian Stage), *Pridaella excentrica* I. Z. and *Pridaella bakalovi* R. Z. (Fassanian Substage and parts of the Longobardian Substage of the Ladinian Stage). The distribution of the conodonts is shown on fig. 3.

The results obtained point at several important deductions:

— the source area for the coarse breccia and conglomerate within the Upper Triassic red beds in the Golo-bârdo Mt. was built up of the Radomir, Rusinovdel and Trân Formations;

— the age interval proven with conodonts embraces the Illyrian Substage of the Anisian, and the Fassanian and parts of the Longobardian Substages of the Ladinian; the absence of conodonts belonging to the *Paragondolella regale* R. Z. and *Paragondolella bulgarica* R. Z. is pointing at the absence of pebbles from limestones of Pelsonian age, i. e. of rocks from the Bosnek Formation;

— Therefore, the dolomite pebbles present most probably belong to the Rusinovdel Formation, and not to the Anisian Bosnek Formation. Pebbles from the Spathian? — Anisian Mogila Formation are also absent. Thus, the source area was eroded during the deposition of the Upper Triassic red beds already at the level of the lowermost parts of the Radomir Formation, i. e. a thickness of ca. 300-500 m has been very quickly washed out;

Table 1

Pebble distribution in the Vetrúška Formation near the mountain hut Slavey

Level	Pebbles, total number on 1 m ²	Dolomites etc.		Limestones		Limestones with conodonts	
		number	%	number	%	number	%
Third	143	89	63	54	37	14	10
Second	126	76	60.5	50	39.5	11	9
First	137	71	52	66	48	15	11

Remark. The first level is at the base of the Vetrúška Formation, the second level — at about 30 m higher in the section, and the third level! — at about 60 m above the base, in the top part of the section.

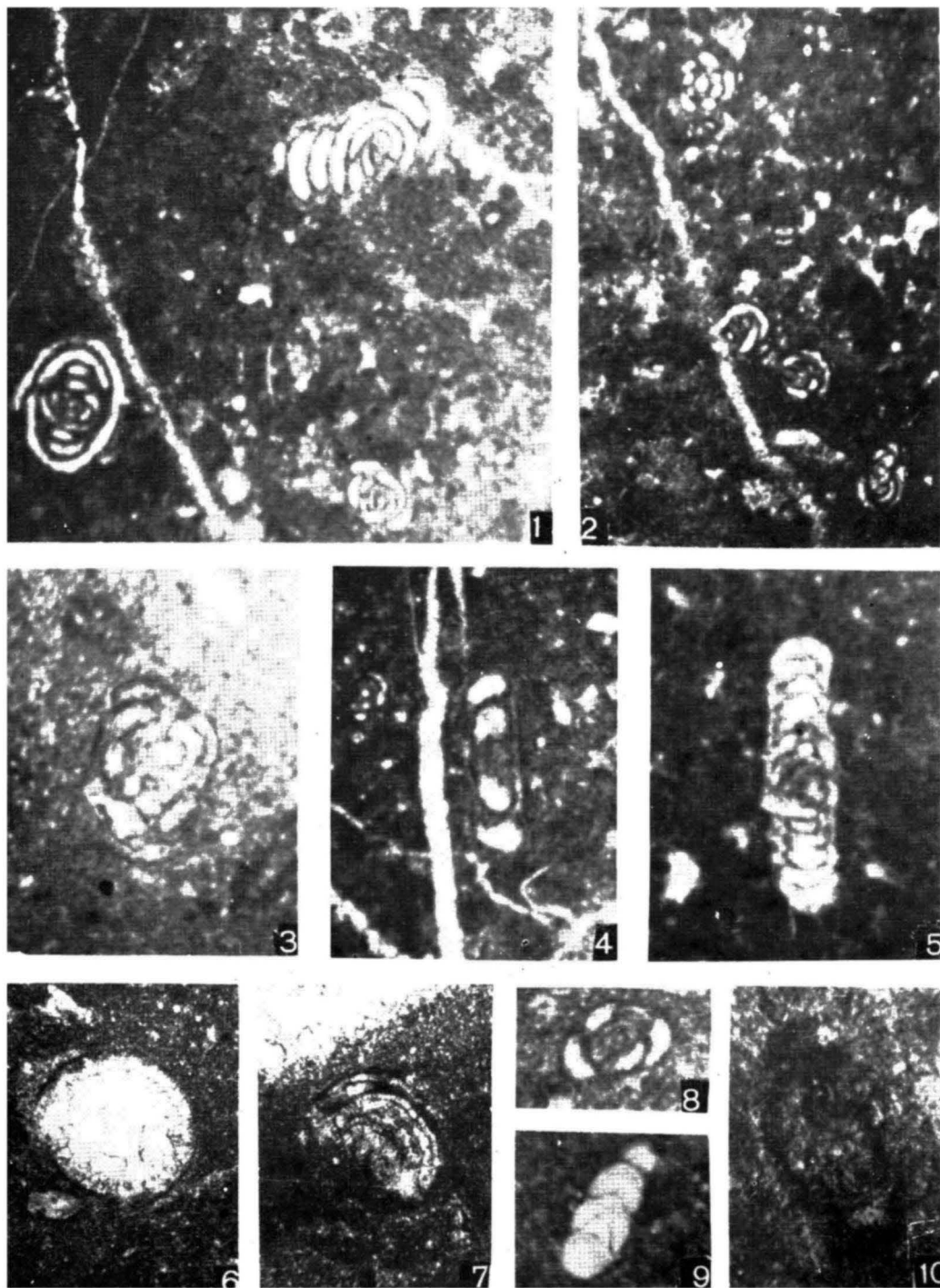


PLATE I

- 1, 2. *Angulodiscus friedli* (Kristan-Tollmann, 1970). NE of the hut Slavey, Golo Bardo Mt., Slavey Formation, Norian, sample 1308; $\times 130$.
3. *Gandinella falsofriedli* (Salaj, Borza, Samuel, 1983). South of Treklijano, near the Beli-Kamak Peak, Komštica Formation, Norian, sample 82-77; $\times 100$.
- 4, 6, 7. *Semiinvoluta clari* (Kristan, 1957). Fig. 4, NE of the hut Slavey, Golo-Bardo Mt., Slavey Formation, Norian, sample 1308; $\times 130$; figs. 6, 7. South of Treklijano, near the Beli-Kamak Peak, Komštica Formation, Norian, sample 82-77; $\times 100$.
5. *Angulodiscus paralellus* Kristan-Tollmann, 1964. Near the Peak Barbul, Slavey Formation, Norian, sample 1347; $\times 130$.
8. *Agathammina austroalpina* Kristan-Tollmann & Tollmann, 1964. NE of the hut Slavey, Golo-Bardo Mt., Slavey Formation, Norian, sample 1310; $\times 130$.
9. *Nodosaria orlinata* Trifonova, 1965. NE of the hut Slavey, Golo-Bardo Mt., Slavey Formation, Norian, sample 1310; $\times 130$.
10. *Miliolipora cuvillieri* Brönnimann & Zaninetti, 1971. SW of Sredorek, at the confluence of the rivers Kobilska and Metohijska, Komštica Formation, Norian, sample 268; $\times 130$.

— the presence of pebbles from a restricted age interval in all three levels of the Upper Triassic breccia-conglomerates certifies a comparatively rapid sedimentation.

Stratigraphy of the Upper Triassic red beds

The Upper Triassic red beds in Bulgaria are referred to the Moesian Group (Вапцарова et al., 1972; Чемберски & Вапцарова, 1979). The following formal lithostratigraphic units have been defined up to now: Komštica Formation (Тронков, 1969); Kozloduj Formation (Монов, 1971); Elena Formation (Вапцарова et al., 1972); Omurtag Formation (Вапцарова et al., 1972); Dulovo Formation (Вапцарова et al., 1972); Kaliakra Formation (Вапцарова et al., 1972); Shabla Formation (Вапцарова et al., 1972); Gorni-Dâbnik Formation (Чемберски et al., 1974); Tučenica Formation (Чемберски et al., 1974); Ambarica Formation (Чаталов, 1984); Borima Formation (Чаталов, 1984).

The Upper Triassic red beds in Southwest Bulgaria have been referred up to now to the Komštica Formation. Трифонова & Загорчев (1984) hinted that probably a new formal lithostratigraphic unit should be introduced under the name "Dragovištica Formation". The problem is discussed in the present paper.

The Moesian Group embraces mostly marine shallow-water deposits formed in most unstable paleogeographic setting of regressing sea and separation of local basins and environments. The presence of continental deposits is also probable. Therefore, some of the formations are isolated being formed within restricted small basins, and other formations are wedging and interfingering due to facies differences. Based on such considerations, Вапцарова et al. (1972) introduced a number of formal lithostratigraphic units in North Bulgaria, and Чаталов (1984) adopted the same approach in the Trojan Stara Planina Mts. We believe that the existing evidence in Southwest Bulgaria is sufficient for to introduce two new formal lithostratigraphic units within the scope of the Moesian Group.

Slavey Formation (Славеева свута) (new Formation)

Name. After the mountain hut Slavey southwest of Pernik.

Type section. Along the road north of the mountain hut Slavey. The section is described hereabove (section Slavey, packets 1, 2 and 3).

Composition and defining features. The Slavey Formation consists of shallow-marine carbonatic to marly sedimentary rocks: red, greenish, grey, pinkish or yellowish marls, dolomites, and oolitic, nodular or biotrititic limestones, often containing coprolites, ostracods, biotritus and foraminifers.

Base and cover. The Slavey Formation covers conformably or with a slight unconformity the dolomites of the Rusinovdel Formation. It is covered either by the red shales of the Komštica Formation or by thick breccias and conglomerates of the Vetruška Formation.

Thickness. The thickness of the Formation varies from 2-3 to 10-12 m, and in exceptional cases may reach up to 20-30 m.

Fossil content and age. The rocks of the Slavey Formation contain foraminifers and ostracods. The samples studied did not yield any conodonts. No determinable macrofossils have been found.

The foraminiferal association (Table 2) includes the species *Agathammina austroalpina* Kristan-Tollmann & Tollmann, *Angulodiscus* cf. *communis* Kristan, *Angulodiscus* cf. *expansus* (Kristan-Tollmann), *Angulodiscus friedli* (Kristan-Tollmann), *Angulodiscus paralellus* (Kristan-Tollmann), *Galeanella* cf. *tollmanni* Kristan, *Miliolipora cuvillieri* Bronnimann & Zaninetti, *Nodosaria ordinata* Трифонова, *Semiinvoluta clari* Kristan. Locally (sample 1308), a mass

Table 2

Foraminiferal taxa in the Slavey Formation (Golo-bârdo Mt.) and Komštica Formation (Zemenska Mt.)

Taxa	Slavey Formation						Komštica Formation		
	1308	1310	1335	1347	1348	1352	82/77	268	390
<i>Agathammina austroalpina</i>								++	++
<i>Angulodiscus cf. communis</i>		++							
<i>Angulodiscus cf. expansus</i>		++							
<i>Angulodiscus friedli</i>	+++	++	+			++	++		++
<i>Angulodiscus cf. minutus</i>									+
<i>Angulodiscus parallelus</i>				++					
<i>Galeanella tollmanni</i>				++					
<i>Gandinella falsotriedli</i>							+		
<i>Miliolipora cuvillieri</i>								+	
<i>Nodosaria ordinata</i>		++					++		++
<i>Semiinvoluta clari</i>	+						++		
<i>Trochammina alpina</i>									++
Duostominidae									++
<i>Tubiphites sp.</i>					++			++	

presence of *Angulodiscus friedli* (Kristan-Tollmann) together with isolated specimens of *Semiinvoluta clari* Kristan has been recorded. The taxa cited are known from the Norian and the Rhaetian in many European localities. The absence of *Triasina hantkeni* Majzon is indicating that the association and the host rocks cannot be referred to the Late Sevatian or to the Rhaetian. Therefore, the age of the Slavey Formation is determined as Norian.

Correlations. The Slavey Formation marks the transition from the Upper Triassic dolomite of the Rusinovdel Formation to the typical red beds of the Moesian Group. It is built up of limestones with coprolites, oolitic and biodetritic limestones, nodular limestones etc. interlayered with thin marls and dolomites. The position of the Slavey Formation over the Rusinovdel Formation and its Norian age correspond to the Trân Formation in the section at the village of Bosnek (Trifonova & Zagorčev, 1990) but the composition of the two Formations is very different: the Trân Formation consists of aphanitic light-grey to whitish limestones. In similar position, the Tvârdica Formation (Ганев & Стефанов, 1977) is situated at the transition between the dolomites of the Rusinovdel Formation and the red beds of the Kozloduy Formation in the Tvârdiška Stara Planina Mts., and the Kumanica Member of the Ambarica Formation (Чаталов, 1984) is accomplishing the transition between the Upper Triassic dolomite of the Trojan Formation and the red beds of the Harman Member of the Ambarica Formation in the Trojan Stara Planina Mts. In the two cases cited, the thickness of the transition beds is of the order of 80 m, and the age is possibly Norian (Tvârdica Formation) or Upper Carnian (Kumanica Member).

Komštica Formation (Tronkov, 1969)

The red beds of the Komštica Formation in the Golo-bârdo Mt. consist of red shales, siltstones and sandstones, often with reduction spots, carbonatic concretions and occasional pebbles; they are interlayered by occasional beds of limestones, marls or pelloid breccia and/or conglomerate, and of quartz sandstones. This character of the Formation corresponds to the regressive marine sediments (Trifonova & Zagorčev, 1984) in the westernmost parts of the Struma zone west of the village of Trekljano, and to the type section of the Komštica Formation in the western Stara-planina Mts (Tronkov, 1969). In the present paper, we are following the revision of Чемберски & Ванцова (1979) who restored the initial definition and type section of Tronkov (1969),

and invalidated the dismemberment of the Formation (Тронков & Моноу, 1971) into "Glavaci Formation" (sandstones), "Beli-izvor Formation" (marls) and "Komštica Formation" (carbonatic breccia-conglomerates). In Southwest Bulgaria Tronkov himself (Бакалов et al., 1983) re-established the use of the name Komštica Formation for the predominantly shaly marine red beds, and we follow the same use thus refuting the previous proposal of Trifonova & Zagorčev (1984) for introduction of a new ("Dragovištica") Formation. On the opposite, the bodies of coarse (psephytic) sediments are insulated in separate subsiding parts of the basin, and partially could be even deposited in continental environments. Therefore, they should be restricted in separate lithostratigraphic units as in the case of the following Vetruška Formation.

The rocks of the Komštica Formation in the Golo-bârdo Mt. did not yield any determinable fossils. In the Zemenska Mts, they contain (Trifonova & Zagorčev, 1984) a foraminiferal association almost identical to that observed in the Slavey Formation in the Golo-bârdo Mt., and namely *Trochammina alpina* Kristan-Tollmann, *Agathammina austroalpina* Kristan-Tollmann & Tollmann, *Angulodiscus friedli* (Kristan-Tollmann), *Gandinella falsofriedli* (Salaj, Borza, Samuel), *Nodosaria ordinata* Trifonova, *Semiinvoluta clari* Kristan. Therefore, the Komštica Formation is also referred to the Norian Stage.

Vetruška Formation (Bempyukova csoma) (new Formation)

Name. After the peak Vetruška (Fig. 2).

Type section. Around and west of the mountain hut Slavey; additional section (with tongue of the Vetruška Formation within the Komštica Formation) south of Orleto west of the peak Vetruška.

Composition and defining features. The Vetruška Formation is built up of red to variegated breccia and conglomerate of carbonatic (grey limestones and dolomites of Middle and Upper Triassic age) pebbles and red carbonatic or clayey-carbonatic matrix. Occasionally, they contain thin interlayers of red sandstones and siltstones.

Base and cover. The breccias and conglomerates of the Vetruška Formation are situated over the Slavey Formation, or cover the Komštica Formation intertonguing with the latter. They are covered unconformably by the Middle Jurassic Polaten Formation near the peak Golema Kulonica.

Age. The position over the Slavey and Komštica Formation points at a Norian (Late Norian — Rhaetian?) age of Vetruška Formation.

Korrelations. The Vetruška Formation is similar to other coarse (psephytic) red beds in Bulgaria. Thus, the breccia formation (Чемберски & Вапцарова, 1979) situated over the Omurtag Formation in Northeast Bulgaria, and the Borima Formation (Чаталов, 1984) in the Central Stara-planina Mts have a similar position and compo-

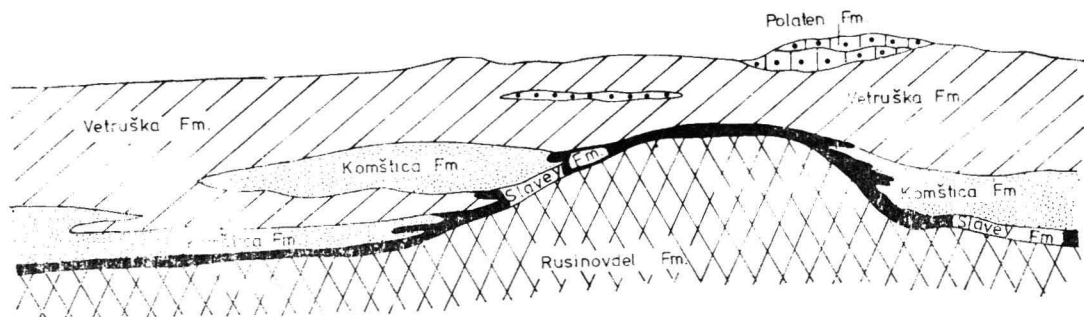


Fig. 4. Schematic longitudinal section for the relations between the Upper Triassic formations in the northern part (Fig. 2) of the Golo-bârdo unit

sition. The tracing of the Vetruška Formation (fig. 2) along a longitudinal section in the Golo-bârdo Mt. (fig. 4) proves that the breccia-conglomerate formations in the Moesian Group may form irregular bodies intertonguing with the sandstone-siltstone formations (Komštica Formation), and their age may vary from the Lower Norian (possibly, from the Upper Carnian) to the Upper Norian (possibly, to the Rhaetian).

Conclusions

The Upper Triassic red beds in the Golo-bârdo Mt. belong to three distinct lithostratigraphic units. They are situated in vertical superposition (from bottom to top: Slavey Formation — Komštica Formation — Vetruška Formation) but show also lateral interfingering. Most characteristically, tongues of the Vetruška Formation (coarse conglomerate or breccia) are penetrating laterally the Komštica Formation (siltstones, sandstones and shales).

The occurrence of the interlayering dolomites, nodular, oolitic and biotrititic limestones with ostracods and (occasionally) foraminifers, marls etc. of the Slavey Formation over the dolomites of the Rusinovdel Formation is typical for the beginning regression, with occasional afflux of fresh waters into the lagoonal shallow basin with increased salinity (previously with evaporitic dolomitic sedimentation). Further on, the sedimentation continued within the shallow lagoonal basin with unstable salinity and formation of local environments of differing salinity and terrigenous supply in conditions of differentiated vertical movements, with intertonguing of the coarse terrigenous fans (Vetruška Formation) coming from the recently uplifted blocks, within the Komštica Formation. The pebble composition of the Vetruška Formation indicates a fast erosion of the rocks belonging to the (from top to bottom) Trân (partially), Rusinovdel and Radomir Formations. The washed-out thickness was of the order of 300-500 m. The comparison with the adjacent regions (tectonic units) shows that the Triassic sections have been only slightly eroded before the Middle Jurassic in the Strumicum (Zagorčev & Dinkova, 1991; Zagorčev et al., 1991), in the Lozen unit (Tronkov, 1981), and in the Golo-bârdo unit itself (Моев, 1968; Тронков, 1975; Zagorčev et al., 1991). The Lower Jurassic Žabljano and Ozirovo Formations or even the Middle Jurassic Gradec and Polaten Formations cover with a slight unconformity the Trân or the Radomir Formation in the Zemen monoclinorium of the Strumicum, the Komštica, Trân or Rusinovdel Formation in the heights SW of the Golo-bârdo Mt. and in the Golo-bârdo unit itself, and the Rusinovdel or Radomir Formation, in the Lozen unit. On the other hand, the same Lower and Middle Jurassic Formations cover with a slight unconformity the deeply eroded (down to the Mogila, Ljubas or even, Mârvodol Formation) Triassic section in the Ljubaš unit immediately northwest of the Golo-bârdo unit, and in the northern part (the mid-Cretaceous Trân anticlinorium built over the Late Triassic — Early Jurassic Ljuckan anticlinorium) of the Strumicum they cover even the deeply eroded Permian Skrino Formation, the whole Triassic section being locally washed out (Динкова et al., 1987; Zagorčev et al., 1991). Thus, the pebbles within the Vetruška Formation came obviously from the adjacent (to the northwest) parts of the Ljubaš unit and of the Late Triassic — Early Jurassic Ljuckan anticlinorium. This fact contradicts also the total allochthoneity of the Golo-bârdo unit supposed by Гочев (1983). Nevertheless, the problems of the Late Triassic paleogeography, tectonics and paleogeodynamics should be discussed in details in a broader regional framework in another paper.

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